PHYSICAL GEOGRAPHY IN THE HIGH SCHOOL

[*Continued from p. 404*]

Practical exercises.—The more progressive teachers of geography, general or physical, elementary or advanced, agree that a well-planned course should include practical exercises in the field and laboratory. Educational journals reflect this opinion in the space that they allow to outlines of practical exercises, concerning which a number of useful suggestions have been published in recent years. But there is not, as yet, any generally adopted plan for this phase of the subject, and its establishment is beset with many serious difficulties against which much effort must be persistently expended before they are overcome. It should be recognized at the outset that all practical exercises should be devised so as to contribute toward a better understanding of the subject, and not merely so as to pander to a fashion that leans toward other methods than those of the text-book. In the second place, the order of exercises should run as nearly parallel as possible to the presentation of the subject in the adopted text-book, so as to enforce and to extend the statements there presented. Some of the difficulties that stand in the way of carrying out these requirements inhere in the nature of the subject; for example, it is not possible to illustrate all the kinds of land forms met in the text-book by actual examples in the local field around the school. Other difficulties must today be laid at the teacher's door; for example, a want of preparation in field observation, so that the local opportunities for field study, often excellent, are almost neglected. Another difficulty concerns the outfit of the laboratory, for which there is no easily obtainable set of materials such as may now be bought for a physical or chemical laboratory. The first of these difficulties cannot be directly overcome, it must be avoided. The other two will be overcome in time; indeed, the rate of progress toward better conditions is today so rapid in the better schools, that one

may have great hopes for the future. Leaving the difficulties aside, let us turn attention to the possibilities and classify them under the four headings of the subject.

The earth as a globe offers a number of interesting exercises; such as determination of the attitude of the earth's axis, establishment of a true meridian and measurement of local variation, a schoolyard imitation of the method of measuring the size of the earth, an extension of the same by correspondence with another school a few hundred miles north or south, measurement of local latitude, determination of local solar time, and difference of longitude between two schools a few hundred miles apart, east and west. Simple and useful exercises for the laboratory may be devised in illustration of the dimensions of the earth as a whole, and of horizontal distances, mountain heights, and ocean depths on its surface. Interesting exercises in the projection and construction of maps may be presented very simply, even to scholars who have not studied formal geometry. The earth as a globe forms many more elementary exercises than most teachers imagine.[1]

Practical work on weather and climate is already well established in many schools. It often lacks the variety that might be given to it, yet it is certainly further advanced today than any other phase of the subject. In connection with the change of seasons, the revolution of the earth around the sun may be really taught observationally, if the teacher will but give a year to it, by leading the scholars to make record at intervals of a fortnight or a month, of star groups that rise in the east shortly after sunset. At the end of an annual circuit, the year as a time unit will be better understood than by memorizing a book definition; the latter method being one of the many cases in which teaching defeats one half of its object by going too fast. It is true that a verbal statement of the fact that the earth goes around the sun once a year can be easily learned and remembered; but there is little in this to cultivate the intelligence. On the other hand, the discovery that an extension of the line from the sun to the

[1] See "Practical Exercises in Geography," *Nat. Geogr. Mag.*, Vol. XI, 1900, pp. 62–78.

earth marks out a circuit through the stars in about 360 days is a lesson in intelligent observation and in the cultivation of one's own power of discovery that should not be neglected if intelligence along with knowledge, and not knowledge alone, is the object of education. It is evident that the method of learning that the earth revolves around the sun should be taught in an earlier year than the one which contains the course on physical geography here considered. The same is true of the annual change in the sun's noon altitude and the associated variation in the length of the day and in the strength of sunshine, and the resulting succession of the seasons. Local observations of weather, the relation of weather to season, and the correlation of local weather with the general phenomena of the weather maps[1] should also advance much more slowly than a class would pass over the corresponding pages in a text-book. All these topics require more time for their observational development than can be allowed in a high-school course; their proper place is in the grammar school. The high-school course following such preparation can advance rapidly to more advanced problems, such as are to be found in abundance, either in connection with local observations or with the comparison of local phenomena with their fellows in other parts of the world.

The ocean can be seen by very few of the scholars in our schools. Those who live near its shores may observe something of waves, shore currents, and tides; those who live on lakes or ponds may observe waves and wind drift, but not tides. Waves, currents, and tides may be imitated by experiments in a tank, but no one has yet undertaken to work out in detail just how such experiments can be best presented. They must always be difficult in schools where crowded class rooms offer the only contact of the teacher and pupil; they may be made relatively easy in schools where a good geographical laboratory is provided. Laboratory exercises on charts of ocean temperatures, depths, currents, and tides may be devised in great variety.

Observational work on the land.—The first chapter on the lands—that concerning the variety of their activities—offers

[1] See *Practical Exercises in Elementary Meteorology*, by R. DeC. Ward. Ginn & Co., Boston, 1899.

many opportunities for local observation, even by young scholars. The effects of rock weathering can be observed outdoors on buildings and rock ledges, and indoors on hand specimens. Transportation of weathered waste by running water is always open to observation and to illustration by experiment. Important principles can be deduced concerning the changes that must be effected on the earth's surface if plenty of time be allowed; and there are very few localities that do not offer sufficient examples of hill or valley forms by which the postulate of "plenty of time" can be established. The erosion of valleys by the action of rain and streams can be established as a highly characteristic feature of the lands by observation and experiment. The tank may be used again to exhibit the hypothetical consequences of elevating or depressing a land mass with respect to a sea level in altering its extent and shore configuration, and maps of actual regions may be at once shown in confirmation of the hypothesis thus illustrated. An intelligent view of the earth may be presented in this way, although care must be constantly taken not to allow the time element of the problem to be hurried. Some study of rocks and minerals may be made in connection with the activities of the lands, but the error of going too far into detail must be guarded against; a very little knowledge of minerals and rocks will suffice for the young geographer, and the small amount that is needed is best introduced directly in connection with the subject that calls for it (as lavas with volcanoes, limestone with caverns) rather than in an independent and preparatory course.

Models and maps.—Under the different kinds of land forms, each local field may be resorted to in connection with the topics for which it gives the best illustrations; but the practical difficulty here is to reach these topics in an out-door season. In any case, the local field should surely be studied in connection with some part of the text, so as to emphasize the reality of the subject that the books treat. Yet even the best fields are so limited in their variety of illustrations that constant resort must be had to models, maps, and pictures. These indoor materials have an advantage over the local field, in that they can be

introduced in connection with any part of the text, at any time and in any order desired. Models are very valuable if well made; they may be actual places or of ideal types. As an example of the first class, mention is made to Harden's model of Morrison's cove, Blair county, Pa., in which the zigzag habit of the Allegheny ridges is well shown: also of Topley's model of the Weald in southeastern England, where the chalk escarpment formed by the erosion of an anticline are well exhibited. For models of larger areas, the United States on a curved surface, like that of the earth, as made by Howell in Washington, are of too small a scale to illustrate local topographical form, but they are of great value in giving correct location to many examples in the text. The cost of a relief globe can be better expended on other things. As examples of the second class, I may be permitted to refer also to the three Harvard models, made under my direction by Mr. G. C. Curtis, and now published by Ginn & Co., Boston. The manifest difficulties in the way of the use of models are their comparative rarity, their expense, their size and their weight; but every school should have at least a few examples. Many exercises may be based upon them, graphic, oral and written. For example, in one of the Harvard models is a small or "young" volcano, whose lava streams have diverted streams and formed lakes in obstructed valleys. The preparation of a map and a written description of these effects of volcanic action would be profitable exercises for high-school or grammar-school pupils. The model of a young coastal plain affords good basis for simple inferences of a truly scientific kind. I have great hopes that a working tank model for the illustration of the development of land forms may be some day devised and reduced to practical form for school use. The ingenuity here needed is much less than that which has been expended in the construction of the apparatus often seen in physical and chemical laboratories, but it would be wasteful to demand the ingenuity of every teacher individually. Lacking the time to construct the model myself, I should be glad to place a workshop, material, and a quantity of advice at the disposition of a properly prepared co-worker — a teacher of experience, with

an inventive turn of mind and hands familiar with tools, preferred — with the confident expectation that results of great value could be obtained in a year's time.

Maps are of two kinds, according to their scales. Those of small scale showing a large area, as in wall maps, suffice to locate the places that are referred to in the text, but not to exhibit topographic form. Maps of large scale, including relatively small areas, would often afford no sufficient clue to their locality if none were named upon them, but they give very valuable illustration of form. The maps published by governmental bureaus in this country and in Europe are of great value here. An important result of placing these maps, now so easily obtained, before pupils in the public schools will be the wide distribution of the knowledge that such maps exist, as well as the formation of a habit of using them. Several lists of selected series of our own maps have been published.[1] These maps are at their best when they illustrate some specific form, as a water-gap cut through one of the Allegheny ridges in Pennsylvania, Maryland or Virginia; or Crater Lake, that remarkable water body occupying a superb volcanic caldera in Oregon; or the extraordinary cusps of Capes Hatteras, Lookout and Fear; or the meanders and the delta of the Mississippi as shown upon the invaluable map of the alluvial basin of the great river prepared by the Mississippi River commission. Definite exercises, partly graphic, partly verbal, can be assigned to pupils on such maps. Such exercises should stand in much the same indispensable relation to geography as that occupied by translation in language study.

Maps of intermediate scale, five or ten miles to an inch, are needed to include parts of a coastal plain large enough to illustrate their relations to one another, to the old land, and to the sea. Maps of this kind are difficult to obtain; the relief

[1] See Governmental maps for use of schools, by Davis, King & Collie, New York, Holt, 1894. Also, *Journal of School Geography*, September 1897, and October 1898. A list of U. S. maps selected for school use is given in Appendix M, to the author's Physical Geography, Ginn & Co., Boston, 1899. Foreign maps are treated in "Large scale maps as geographical illustrations," *Journal of Geology*, Chicago, IV, 1896, 484-513.

map of New Jersey shows part of a coastal plain of longitudinal relief; the geological map of Alabama presents the pattern of overlapping strata, but not the relief in a similar form, and hence is less serviceable for young scholars.

Pictures are very useful when in the form of lantern slides for projection, so that an entire class can see them at once, while the teacher presents appropriate explanations, but lantern slides should be supplemented if possible by pictures of large enough size and clear enough drawing to give good illustration of certain forms for description, when placed before the members of the class for individual study in the laboratory. A cañon, a mesa, an alluvial fan, or other small items of form can be thus portrayed. Specific exercises on such pictures are sometimes difficult to invent; but the translation of the picture into words and the explanation of its facts in accordance with the principles developed by previous study, afford useful preparation for observation during travel.

Place of physical geography in the school curriculum.—The place of physical geography in the school curriculum has been much discussed. The report of the Committee of Ten, adopting the recommendations of their subcommittee on geography, advised a general course of physical geography in the first year of the high-school course, and more special and advanced courses in "physiography," meteorology, astronomy or geology in the last year. The recent report of the National Educational Association on college admission requirements, following the advice of their subcommittee, makes a similar recommendation; the first cited report gives most detail to its outline of the higher courses, and the second report devotes most of its attention to the lower and more general course. My belief is that the latter will not remain very long in the better high schools, and that, as it descends into the grammar schools, its place will be taken by elective courses near the end of the high-school course. The reasons for this belief are as follows. First, a number of good grammar schools are already teaching, under "geography" or "physical geography" much material recommended in the National Educational Association report as

appropriate for the first year of the high school. Second, the rapid improvement of the grammar-school course in general geography, by omitting much old *memoriter* work and compressing the valuable remainder into shorter time, is actually providing a place for physical geography in the last year of the grades. Such a change must come to be generally approved, when it is seen how large a part of elementary physical geography is within reach of the grammar schools, and when it is remembered that every study thus added to the lower grades reaches a vastly greater number of school children than it would reach in the high school. Still more important is the third and final reason, namely, a growing belief that the existing methods of teaching geography in the grades is not rational enough to stimulate as fully as it should the mental activity of school children ; the remnants of traditional methods in geography by which young intelligence is often hampered should therefore be replaced by an increasing attention to explanatory and practical methods, such as the subject of physical geography affords in an admirable way. For the present, the establishment of a good course in physical geography in the first high-school year is probably the best general plan ; but it is not likely that the subject will hold a permanent place there. Ten years hence, elementary physical geography will have found its way into many grammar schools ; twenty or thirty years hence, the high school that has physical geography in its first year and not in its third or fourth will be considered old fashioned.

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